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वैमानिक गैसोलीन — विशिष्टि

(तीसरा पुनरीक्षण)

Indian Standard

AVIATION GASOLINE — SPECIFICATION

(Third Revision)

UDC 665.733.3

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 1994 **Price Group 2**

Petroleum Products Sectional Committee, PCD 3

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards after the draft finalized by the Petroleum Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

This standard was originally published in 1960. First revision was taken up in 1967 and the second in June 1982. This third revision has been necessitated by the changes in various factors. In the recent years the demand of aviation gasoline has steadily decreased at International level and many of the foreign oil companies have started discontinuing the production of many grades of aviation gasoline especially low octane number fuels. Because of short supply and other growing difficulties, a common grade 100 LL aviation gasoline is normally available in International market. In view of this, International airworthiness agencies like Federal Aviation Administration in USA and Civil Aviation Authority in UK have approved the use of MO GAS conforming to ASTM D 4814 and BS 4040 four star specification in low compression ratio engine having compression ratio 7.2 or less equipped in light aircraft for general aviation purpose being an alternative fuel to 80/87 low octane aviation grade. However, the specification for 80/87 grade has been retained till a substitute to this grade is indigenously available. The need for International Coordination among recognized standard of other countries on the subject is particularly significant for the product of this type since refueling of aircraft in different countries is often involved.

These considerations led this standard to be based on DERD 2485 (Issue No. 9) issued by the Ministry of Defence, UK, ASTM D 910-91a and other available sources in the aeronautical field.

Accordingly, the approved additive system viz, anti-oxidants, static dissipator additives, etc, have been adopted as given in the Qualified Product List (QPL) (erstwhile Approved Product List of Aircraft Materials to Specification DERD 2485) published by the Procurement Executive, Ministry of Defence, Directorate General Aircrafts, 3 St. Giles High Street, London WC 2H 8LD.

In this revision grades 73 and 100L have been omitted and only two grades viz, 100 LL, 80 have been retained and the requirements modified to suit the end-use requirements.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the results of test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

AVIATION GASOLINE — SPECIFICATION

(Third Revision)

1 SCOPE

This standard prescribes the requirements and methods of sampling and test for aviation gasoline intended for use in aircraft reciprocating engines.

2 NORMATIVE REFERENCES

The following standards contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
1260 (Part 1) : 1973	Pictorial marking for handling and labelling of goods: Part 1 Dangerous goods (*first revision*)
1447 : 1966	Methods of sampling of petroleum and its products
1448	Methods of test for petroleum and its products
2631 : 1976	*iso* propyl alcohol (*first revision*)
7667 : 1975	Code of practice for handling and storage of aviation fuels at airfield fueling station

3 GRADES

The material shall be of the following grades:

a) Grade 80; and
b) Grade 100 LL.

4 REQUIREMENTS

4.1 General

The material shall provide, prescribe required properties of aviation gasoline and shall give good performance when used in appropriate aero engines for which the particular grade of the material is specified by the manufacturer.

4.2 Composition

The material shall consist completely of hydrocarbon compounds, like blends of refined hydrocarbons derived from crude petroleum, natural gasoline or blends thereof with synthetic hydrocarbons or aromatic hydrocarbons or both except for the compounds specified in **4.2.1** to **4.2.4**.

4.2.1 *Anti-oxidants*

A qualified anti-oxidant or a mixture of qualified anti-oxidants may be added to the material in order to prevent the formation of gum and the precipitation of lead compounds. The total concentration of the active anti-oxidant(s) added shall be not less than 19 g/kl and more than 25 g/kl. The following are the list of qualified anti-oxidants:

a) 2,6-di-tert-butyl-phenol;
b) 4-methyl-2,6-di-tert-butyl-phenol;
c) 2,4-di-methyl-6-tert-butyl-phenol;
d) 75 percent minimum, 2,6-di-tert-butyl-phenol
   25 percent maximum, mixed tertiary and di-tertiary-butyl phenol;
e) 55 percent minimum, 2,4-di-methyl-6-tert-butyl-pehnol
   15 percent minimum, 4-methyl-2,6-di-tert-butyl-phenol
   30 percent maximum, mixed methyl and di-methyl tertiary-butyl phenols;
f) 72 percent minimum, 2,4-di-methyl-6-tert-butyl phenol
   28 percent maximum, mixed methyl and di-methyl tertiary butyl phenols;
g) 60 percent minimum, 2,4-di-tert-butyl-phenol
   40 percent maximum, mixed tertiary butyl phenols;
h) 35 percent minimum, 4 methyl-2, 6-di-tert-butyl-phenol
   65 percent, maximum mixed methyl, ethyl and dimethyl tertiary butyl phenols;
j) 55 percent minimum, butylated ethyl phenols
   45 percent, butylated methyl and di-methyl phenols.

4.2.1.1 The supplier shall, if required by the purchaser or his authorized agent, disclose the nature and concentration of antioxidants which has been added to the fuel supplied.

4.2.2 *Tetraethyl lead*

Tetraethyl lead may be added to Grades 80 and 100LL of the material in concentration not exceeding the limits specified in Table 1. The tetraethyl lead shall be in the form of anti-knock mixture containing not less than 61 percent by mass of tetraethyl lead and sufficient ethylene dibromide to provide two atoms of bromine per atom of lead. The balance shall contain kerosene, the qualified inhibitor and qualified blue dye only.

Table 1 Requirements for Aviation Gasoline
(*Clauses* 4.2.2 *and* 4.3)

Sl No.	**Characteristics**	**Requirements for**		**Method of Test Ref to (P :) of IS 1448***
		Grade 80	Grade 100 LL	
(1)	(2)	(3)	(4)	(5)
i)	Appearance	Clear, bright free from solid matter and undissolved water at normal ambient temperature		—
ii)	Copper strip corrosion for 2 hours at 100°C	Not worse than No. 1		P : 15
iii)	Density at 15°C, g/ml	← Report →		P : 16
iv)	Distillation			
	a) Initial boiling point, °C	← Report →		P : 18
	b) Fuel recovered:			
	10 Percent by volume at °C, *Min*	← 75 →		
	40 Percent by volume at °C, *Max*	← 75 →		
	50 Percent by volume at °C, *Max*	← 105 →		
	90 Percent by volume at °C, *Min*	← 135 →		
	c) Final boiling point °C, *Max*	← 170 →		
	d) Sum of 10 and 50 percent fuel recovered temperature °C, *Min*	← 135 →		
	e) Residue, percent by volume, *Max*	← 1.5 →		
	f) Loss, percent by volume, *Max*	← 1.5 →		
v)	Existent gum, mg/100 ml, *Max*	← 3.0 →		P : 29
vi)	Freezing point, °C, *Max*	(−58) →		P : 11
vii)	Knock rating (*see* Note 1):			
	a) Lean mixture, motor method, octane number, *Min*	80	99.5	P : 26
	b) Rich mixture, performance number, *Min*	—	130	P : 46
viii)	Oxidation stability, 16 h			P : 28 (Method B)
	a) Potential gum, mg/100 ml, *Max*	← 6 →		
	b) Precipitate, mg/100 ml, *Max*	← 2 →		
ix)	Reid vapour pressure 38°C, kPA	← 38.0 to 48.5 →		P : 39
x)	Specific energy, net J/g *Min*	← 43500 →		P : 6
	or			
	Aniline gravity product, *Min* (*see* Note 2)	← 7500 →		P : 3
xi)	Sulphur, total, percent by mass, *Max*	← 0.05 →		P : 34 (Method B)
xii)	Tetraethyl lead, ml/l at 15°C, *Max*	0.13	0.53	P : 82
xiii)	Water reaction			P : 42 (Method A)
	a) Interface rating, *Max*	← 2 →		
	b) Separation rating, *Max*	← 2 →		
	c) volume change, ml, *Max*	← 2 →		
xiv)	Electrical conductivity ps/m (at the point, time and temperature of delivery to the purchaser)	(*see* Note 3)		P : *

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*Under preparation. Till such time the method given under IP 274/82 may be followed.

NOTES

1 Knock rating shall be reported to the nearest 0.1 octane/performance number.

2 Aniline Gravity Product = (API Gravity) × Aniline Point (°F). An estimate of net Specific Energy (in units of MJ/kg) can be made from Aniline Gravity Product using either Table 1 or equations 1 and 5, of joint method ASTM D 1405/IP 193.

3 When a static dissipator additive has been added to the fuel the conductivity at the point, time and temperature of delivery to the purchaser shall be in the range of 50 to 600 ps/m.

4.2.3 *Static Dissipator Additive*

Where so required by the purchasing authority, in the interest of safe handling of product and/or aircraft, a qualified static dissipator additive may be added to the fuel to impart the required electrical conductivity. The following materials are qualified:

a) Shell antistatic additive ASA-3 in a concentration not exceeding 1.0 mg/l

b) Dupont STADIS 450 in a concentration not exceeding 3.0 mg/l.

4.2.4 *Fuel System Icing Inhibitor*

Type I – Ethylene glycol monomethyl ether (EGME) (conforming to the requirements of ASTM D 4171) may be used in concentration of 0.1 to 0.15 volume percent.

Warning : EGME (2-methoxyethanol) is hazardous.

Precautions : Avoid skin and eye contact and inhalation of its vapour to avoid possible adverse health effects.

Type II — Isopropyl alcohol conforming to the requirements of Specification IS 2631 : 1978/ASTM D 4171 may be used in concentration recommended by the aircraft manufacturers when required by the aircraft owner operator.

NOTE — Addition of isopropyl alcohol may reduce knock rating below minimum specification values.

4.2.5 *Dyes*

The following dyes shall be present in the material in concentrations specified in Table 2:

Blue — Essentially alkyl substituted aminoanthraquinone

Red — Essentially alkyl derivatives of azobenzene 4-azo-2-naphthol

4.2.6 *Colour*

The visual colour of the material shall be as given in Table 3. If correctly dyed, the colour should also fall within the limits specified in Table 3. Composite glasses containing maximum and minimum shades for each grade, based on the limits given in the table may also be used.

Table 2 Dye Concentrations
(*Clause* 4.2.5)

Sl No.	Colour of the Dye	Concentration in mg/l	
		Grade 80	Grade 100 LL
(1)	(2)	(3)	(4)
i)	Blue	0.40, *Max*	0.71 to 1.51
ii)	Red	1.83 to 2.29	Nil

Table 3 Requirements for Colour
(*Clause* 4.2.6)

Sl No.	Colour of the Dye	Concentration in mg/l		Method of Test, Ref to (P :) of IS : 1448
		Grade 80	Grade 100 LL	
(1)	(2)	(3)	(4)	(5)
i)	Colour, visual	—	Blue	—
ii)	Colour by Lovibond tintometer in 50.8 mm cell			P : 13
	(a) Blue	-	1.7 to 3.5	
	(b) Red	6.7 to 9.1	-	

4.3 The material shall also comply with the requirements prescribed in Table 1 when tested according to the appropriate method prescribed under 'P' series of IS 1448. Reference to the relevant test methods is given in col 5 of Table 1.

5 PACKING AND MARKING

5.1 Packing

The material shall be packed in suitable containers as agreed to between the purchaser and the supplier subject to any rules and regulations in force in the country.

5.2 Marking

The material shall be supplied in accordance with the marking and delivery instructions given by the purchaser.

5.2.1 Each container shall be marked with the following information:

a) Name and grade of the material;

b) Indication of the source of manufacture, initials or trade-mark, if any;

c) Volume of the contents in litres; and

d) Year of manufacture or packing.

5.2.2 Each container shall also be marked with the caution label 'HIGHLY FLAMMABLE' together with the corresponding symbol for labelling dangerous goods [*see* IS 1260 (Part 1) : 1973].

5.3 BIS Certification Marking

Each container may also be marked with the Standard Mark.

5.3.1 The use of the Standard Mark is governed by the provisions of, Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

6 SAMPLING

6.1 Representative samples of the material shall be drawn as prescribed in IS 1447 : 1966.

6.2 All characteristics given in the specification shall be tested on the composite sample.

6.3 The lot shall be declared as conforming to the requirements of the specification if all the test results on the composite sample meet the relevant specification requirements.

7 HANDLING AND STORAGE

For the safe handling and storage of the fuel the instructions and guidelines given in IS 7667 : 1975 shall be followed.

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Amendments Issued Since Publication

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